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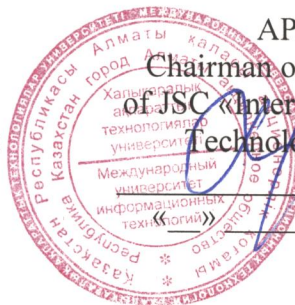
Chairman of the Educational and  
Methodological Department  
Council of JSC «International Information  
Technology University»

  
Mustafina A.K.  
«19» 03 2024

APPROVED

Chairman of the Board-Rector  
of JSC «International Information  
Technology University»

  
Khikmetov A.K.  
2024



## EDUCATIONAL PROGRAM

### 6B06106 «Computer Systems and Software Engineering»

Code and classification of the field of education: 6B06 – Information and Communication Technology

Code and classification of training area: 6B061 – Information and Communication Technology

Group of educational programs: B057 – Information Technology

ISCED level: 6

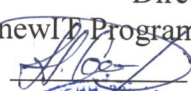
NQR level: 6

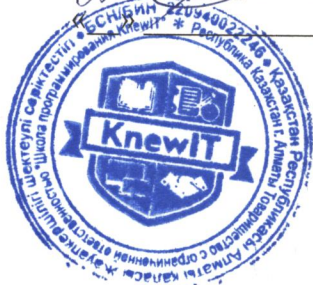
ORC level: 6

Duration: 4 years


Number of credits: 240

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Director of

«KnewIT Programming School» LLC  
  
Bekaulov N.M.  
2024



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Director of

«ProTechSolutions» LLC  
  
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2024



Almaty, 2024

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## List of abbreviations and notation

BC	Basic competence
BM	Base module
HE	Higher education
SCES	State compulsory education standard
EQF	European qualification framework
EEF	European Education Foundation
KSC	Knowledge, skills, cum-savvy
NCO	National Classification of Occupations
NQF	National Qualifications Framework
NQS	National qualifications system
HM	Humanitarian module
CM	Common module
EP	Educational program
GPM	General Professional Module
IQF	Industry Qualifications Framework
PS	Professional standard
PE	Postgraduate education
PC	Professional competence
PM	Professional module
SW	Software
WG	Working group
RK	The Republic of Kazakhstan
LO	Learning outcome
SM	Special module
QMS	Quality Management System
SEM	Socio-economic module
TVE	Technical and vocational education
TaVPE	Technical and vocational education and post-secondary education
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO	Specialized agency of the United Nations Educational, Scientific and Cultural Organization
Cedefop	European Center for Development of Vocational Training
DACUM	from Eng. Developing curriculum
ECVET	European Credit System for vocational education and training
EQAVET	European Quality Assurance in Vocational Education and Training
ENQA	European Association for Quality Assurance in Higher Education / Europe-Skye association by to ensure qualities at higher education
ESG	Standards and Guidelines for Quality Assurance in the European Higher Education Area
FIBAA	International Agency (non-profit foundation) for accreditation and examination of the quality of higher education (Bonn, Germany)
IQM-HE	Internal Quality Management in Higher Education
TACIS	Technical Assistance for the Commonwealth of Independent States
WSI	WorldSkills International



## 1 Description of the educational program

The educational program 6B06106 «Computer Systems and Software Engineering» is designed to implement the principles of a democratic nature of educational management, expanding the boundaries of academic freedom and the authority of educational institutions, which will ensure the adaptation of the technical and vocational education system to the changing needs of society, the labor market economy. The flexibility of the program will allow you to take into account the abilities and needs of the individual, production and society.

The educational program ensures the application of an individual approach to students, ensures the transformation of professional competencies from professional standards and qualification standards into learning outcomes. Provides student-centered learning - the principle of education, involving a shift in emphasis in the educational process from teaching to learning.

The educational program «Computer Systems and Software Engineering» prepares specialists of a wide profile in the field of software development for any areas of human activity. Preparation for this educational program includes disciplines that form competencies in the field of data analysis and machine learning, network technologies, robotic systems and graphic computing.

The area of professional activity of graduates is state and private enterprises and organizations that develop, implement and use computer hardware and software in various fields, namely: telecommunications, science and education, healthcare, agriculture, mechanical engineering, metallurgy, transport, services, administrative management, economics, business, various technology management, etc.

## 2 The goal and objectives of the educational program

**The goal of the EP** – is to provide practice-oriented training of highly qualified specialists in software development in various fields with competencies in the field of data analysis, network technologies, robotics and graphic computing.

### **The objectives of the EP:**

1. To prepare a universal specialist who has knowledge in mathematics, ICT, computer sciences; able to use modern information and communication technologies in substantive activities.
2. To teach students how to formalize the subject area of a software project and develop specifications for software product components.
3. To develop the ability to design software architecture and provide a high level of continuity and quality of complex software development.
4. To teach students to design and develop user interfaces, commercial software components, databases and embedded software modules.
5. To acquaint students with the methods and tools for researching software code to identify / eliminate errors and malfunctions in the software.
6. To provide knowledge to students on the design of logical database schemes using relational, object-oriented, object-relational, key-value schemes for simple and complex defined systems.
7. To acquaint students with data analysis methods and machine learning algorithms for their application in various fields of human detail.
8. To develop students' skills in developing multi-robotic systems using artificial intelligence, sensory technologies, IoT, etc.
9. To train students in network technologies to configure networks of various sizes, prevent threats and troubleshoot.
10. To acquaint students with advanced technologies of three-dimensional visualization.



### 3 Requirements for the results of the mastering of the educational program

The following examination forms are used as an assessment of learning outcomes: computer testing, a written exam (answers on the sheets), an oral exam, a project (passing a course project), practical (open questions on a computer, solving problems on a computer, including in ACM format) comprehensive (test / written / oral + others). In accordance with table 1, the following exams are recommended:

Table 1

№	Exams form	Recommended share, %
1	Test	10%
2	Written	10%
3	Oral	5%
4	Project	30%
5	Practical	30%
6	Complex	15%

Final attestation is help on the form of defending a diploma project.

### 4 Passport of the educational program

#### 4.1 General information

№	Field name	Note
1	Code and classification of the field of education	6B06 – Information and Communication Technology
2	Code and classification of training areas	6B061 – Information and Communication Technology
3	Group of educational programs	B057 – Information Technology
4	Name of the educational program	6B06106 Computer Systems and Software Engineering
5	Short description of the program	The educational program «Computer Systems and Software Engineering» prepares specialists of a wide profile in the field of software development for any areas of human activity. Preparation for this educational program includes disciplines that form competencies in the field of data analysis and machine learning, network technologies, robotic systems and graphic computing.
6	Purpose of EP	To provide practice-oriented training of highly qualified specialists in software development in various fields with competencies in the field of data analysis, network technologies, robotics and graphic computing
7	ISCED level	6
8	NQF level	6
9	IQF level	6
10	Qualification characteristics of the EP graduate	<b>Field of professional activity of the graduate of the EP:</b> The field of professional activity of the EP “6B06106-Computer technology and software” is mathematical, information, software, linguistic, technical and organizational-legal support of information systems, including technologies for design, development, implementation, maintenance and operation.

	<p><b>Objects of professional activity of graduates of the EP:</b> Objects of professional activity of graduates of the EP “6B06106-Computer technology and software” are computers, complexes, systems and networks; - computer systems for information processing and management; - computer-aided design systems; - software for computer technology and information systems.</p> <p><b>Subject of professional activity of graduates of the EP:</b> The subject of professional activity of graduates of the EP “6B06106-Computer technology and software” is mathematical, information, software, linguistic, technical and organizational and legal support of information systems, including technologies for design, development, implementation, maintenance and operation .</p> <p><b>Types of professional activities of EP graduates:</b></p> <ul style="list-style-type: none"> <li>- operation of all types of computer systems;</li> <li>- design and engineering;</li> <li>- production and technological;</li> <li>- experimental research;</li> <li>- organizational and managerial.</li> </ul> <p><b>Functions of professional activity of EP graduates:</b></p> <p>design and engineering activities:</p> <ul style="list-style-type: none"> <li>- development and execution of design and working technical documentation;</li> <li>- monitoring the compliance of developed projects and technical documentation with standards, technical specifications and other regulatory documents;</li> <li>- design and technological activities: the use of Web technologies in the implementation of remote access in client/server systems and distributed computing;</li> <li>- production and technological activities: creation of components of computer information processing and management systems, production of programs and software systems of a given quality; testing and debugging of hardware and software systems;</li> <li>- organizational and managerial activities: organization of workplaces, their technical equipment, placement of computer equipment; selection of technology, software tools and computer equipment when organizing the process of development and research of objects of professional activity;</li> <li>- research activities, innovation activities; installation and commissioning activities;</li> <li>- installation, debugging and configuration of technical means for putting software into operation; operation of software and their components.</li> </ul>
11	List of competencies :



	<p>GC1: To know: socio-ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities; history, traditions and culture of the peoples of Kazakhstan; human and civil rights and freedoms; fundamentals of the legal system and legislation of Kazakhstan; trends in the social development of society; the basics of physical culture and the principles of a healthy lifestyle.</p> <p>GC2: To be capable of written and oral communication, including professional in the state language, the language of interethnic communication and English; ability is logically true, reasoned and clearly build oral and written speech.</p> <p>BC1: To be competent in the choice of mathematical modeling methods for solving specific engineering problems, including the willingness to identify the natural science essence of the problems arising in the process of professional activity, and the ability to attract the appropriate physical and mathematical apparatus for its solution.</p> <p>BC2: The ability to use modern information and communication technologies in substantive activities, to analyze information sources.</p> <p>BC3: The ability to analyze the architecture of computer systems, the main components of a computer.</p> <p>PC1: The ability to formalize the subject area of a software project and develop specifications for software product components.</p> <p>PC2: The ability to design and develop user interfaces, commercial software components, databases and embedded software modules.</p> <p>PC3: To be competent in choosing software, DBMS, programming language.</p> <p>PC4: The ability to manage the software development process, the development team, as well as evaluate the economic efficiency of the project.</p> <p>PC5: The ability to design, configure, operate computer systems and networks.</p> <p>PC6: The ability to analyze various types of data, apply knowledge extraction methods.</p> <p>PC7: The ability to design, develop and operate robotic systems.</p> <p>PC8: The ability to develop three-dimensional visualizations using modern technologies.</p>	
12	<p>Learning outcomes. Students will be able to:</p> <p>LO1: Demonstrate the ability to use basic math tools to solve professional problems.</p> <p>LO2: Analyze the structure of the main components of the computer, use a wide range of technologies of internal and external memory; write program code for manipulating bits in the processor.</p> <p>LO3: Apply suitable data structures and develop appropriate algorithms for solving various computational problems.</p> <p>LO4: Apply various tools for software development, user interface, storage and data processing systems.</p> <p>LO5: Use various software development methodologies, draw up software documentation using the required diagrams, develop models of the logical and physical architecture of the software system, database, and manage the development process.</p> <p>LO6: Develop effective data storage systems and methods for their processing and analysis using machine learning algorithms.</p> <p>LO7: Own technologies for administering systems and networks of any configuration, troubleshooting and threat prevention.</p> <p>LO8: Design, operate and maintain robotic systems.</p> <p>LO9: Demonstrate the skills to develop complex three-dimensional visualizations using computer vision technologies, augmented and virtual realities.</p> <p>LO10: Independently critically analyze modern sources, draw conclusions, argue them and make decisions based on information.</p>	
13	Form of study	Full-time
14	Language of instruction	English
15	Number of credits	240 ECTS credits



16	Awarded academic degree	Bachelor in Information and Communication Technology in educational program 6B06106 «Computer Systems and Software Engineering»
17	Developers and authors:	«International Information Technology University» JSC, Computer Engineering Department: <ul style="list-style-type: none"> <li>- T.T. Chinibayeva, PhD, head of the «CE» department, assistant professor</li> <li>- Zh.M. Bekaulova, MSc, senior-lector of the «CE» department</li> </ul>

#### 4.2 Matrix of correlation of learning outcomes of the educational program with competencies

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10
BC1	V									
BC2										V
BC3		V								
PC1					V					
PC2			V	V		V				
PC3			V	V						
PC4					V					
PC5							V			
PC6						V				
PC7								V		
PC8									V	

#### 4.3 Information about courses

Code	Name of the course	Short description of the course	Number of credits	Formed competencies (codes)	Prerequisites	Postrequisites
<b>1 General disciplines (GD)</b>						
<b>1.1 Mandatory component (MC)</b>						
HK 6002	History of Kazakhstan	The laws of the historical process, the place of man in the historical process are studied. Historical knowledge is given about the main stages of development of modern Kazakhstan; focuses on the problems of historical and cultural processes and the development of Kazakhstan.	5	GC1	No	Philosophy
SPS 6001	Philosophy	Studying the principles of understanding philosophy as a methodology of human activity, the main directions and problems of the world. The formation of a holistic vision of philosophy as a special form of knowledge of the world, its main problems and methods of	5	GC1	History of Kazakhstan	Research methodology

		studying them in the context of future professional activity.				
LAN 6001A	Foreign language	Written and oral communication skills in English are taught.	5	GC2	no	Professionally-oriented foreign language
LAN 6002A	Foreign language	Written and oral communication skills in English are taught.	5	GC2	no	Professionally-oriented foreign language
LAN6001KR	Kazakh (Russian) language	The skills of written and oral communication in the state language (the language of interethnic communication) are inculcated.	5	GC2	no	Business correspondence in the state language
LAN6002KR	Kazakh (Russian) language	The skills of written and oral communication in the state language (the language of interethnic communication) are inculcated.	5	GC2	no	Business correspondence in the state language
ICT6001	Information and communication technology	The skills of applying information and communication technologies in substantive activities are taught.	5	BC2	no	Basics of computer networks, Operating Systems Basics
SPS6007	Sociology-Political science	The fundamentals of global political processes and the laws of political life are being studied. The development of sociological imagination, understanding of sociology as a science. The study of sociological subject areas, directions and research methods. The basic concepts of sociological theories are discussed, as well as how society and social processes determine our life.	4	GC1	no	Cultural studies-Psychology
SPS6006	Cultural studies-Psychology	As a result of studying a course in the field of cultural studies, students will acquire the fundamentals for studying the entire complex of social sciences and humanities, and master intercultural communication. At the same time, the discipline of cultural studies can serve as an addition to general courses in history and philosophy. The course material can serve as a methodological guide for a number of special disciplines: for example, ethics, history of culture, styles of art, national schools of management, strategy and negotiation tactics, management of	4	GC1	no	Research methodology



		culture. Methods and technologies of training used in the implementation of the program: role-playing games and educational discussions in various formats; case study, project method. The psychology course studies main issues of psychology in a wide educational and social context. Knowledge and skills gained in the course give students the opportunity to practically apply them in different life spheres such as personal, family, professional, business, social (working with people of different age and social categories).				
PhC6005	Physical training	The ability to understand the practical use of healthy living standards, including prevention issues, is being instilled.	4	GC1	no	
PhC6006	Physical training		4	GC1	no	
<b>1.2 General disciplines (EC)</b>						
RM6502	Research methodology	The course is devoted to the study of activities aimed at developing students' ability to independent theoretical and practical judgments and conclusions, skills of objective evaluation of scientific information, freedom of scientific research and the desire to apply scientific knowledge in educational activities, including for the diploma project (work).	5	GC1	Culturology-Psychology	Diploma design
ECO6006	Economic theory	The course goal is to study and explain processes and the phenomena of economic life, and for this purpose it should get into an essence of deep processes, explain laws and predict ways of their use. attempts to provide comprehensive coverage of all the key elements in the discipline	5	GC1	Culturology-Psychology	Diploma design
FIN6720	Basics of Financial Literacy	The course «Basics of Financial Literacy» is aimed at gaining knowledge and skills in the field of personal finance management. As part of the course, students will learn how to use all kinds of financial tools in practice, protect and increase savings, plan a budget competently, gain practical skills in calculating and paying taxes, and correctly filling out tax reports, learn how to analyze financial information and navigate financial products to choose an adequate investment strategy.	5	GC1	no	Diploma design
JUR 6470	Fundamentals of law and anti-corruption culture	Studying ways of safe human interaction with the environment (industrial, domestic, urban, natural), sustainable operation of business facilities (organizations) in emergency situations, issues of	5	GC1	Sociology-Political Science	Diploma design



		protection from negative factors, prevention and elimination of the consequences of natural and man-made emergencies and the use of modern means defeat. Also the course reveals the role of ecology in solving modern economic, social and political problems, as well as the emergence of global environmental problems as a result of human production activities and the responsibility of the world community for them. A very important aspect is also international cooperation to ensure sustainable development. Various areas of practical application of ecology are also considered - natural resources and environmental pollution.				
MGT6706	Startups and entrepreneurship	This course provides an introduction to what a business is, how it works and how to run it. Students will define ownership and processes used in manufacturing and marketing, finance, personnel, and management in business operations.	5	GC1	no	Diploma design
JUR 6507	Fundamentals safety of life activity and ecology	Studying ways of safe human interaction with the environment (industrial, domestic, urban, natural), sustainable operation of business facilities (organizations) in emergency situations, issues of protection from negative factors, prevention and elimination of the consequences of natural and man-made emergencies and the use of modern means defeat. Also the course reveals the role of ecology in solving modern economic, social and political problems, as well as the emergence of global environmental problems as a result of human production activities and the responsibility of the world community for them. A very important aspect is also international cooperation to ensure sustainable development. Various areas of practical application of ecology are also considered - natural resources and environmental pollution.	5	GC1	no	Diploma design
<b>2 Basic disciplines (BD)</b>						
<b>2.1 University component (UC)</b>						
PHY6001	Physics	Studying the basic laws of classical mechanics, electricity, magnetism, thermodynamics, quantum mechanics, special relativity in search of ways to solve physical problems.	7	BC1, BC3	Mathematical analysis	Theory of electrical circuits

MAT6001**	Algebra and geometry	Studying the elements of linear algebra and analytic geometry using real life and various science examples.	4	BC1	No	Mathematical analysis
SFT6301	Algorithmization and programming	More complex, advanced algorithms and data structures using the C++ programming language are considered.	6	PC2, PC3	No	Mathematical analysis
MAT6002	Mathematical analysis	We consider such concepts as limits and differentiation of functions of one variable, indefinite and definite (Riemannian) integrals of functions with applications, as well as an introduction to topics related to ordinary differential equations.	6	BC1	Information and communication technology	Operating Systems
MAT6006	Theory of probability and mathematical statistics	The course focuses on the probability and statistics of any events, as well as on the relationship between mathematics and programming through an interdisciplinary training program that deepens the mathematical understanding of probability and develops the skills of logical and algorithmic thinking.	4	BC1	Algebra and geometry	Theory of information
MAT6005	Discrete math	The study of discrete objects, the solution of combinatorial problems, the study of types of mappings and binary relations, the reduction of propositional algebra formulas to normal forms, the application of logic algebra to the theory of switching circuits. The capabilities for analysis and synthesis, and mathematical maturity are developing.	4	BC1	Algebra and geometry	Theory of information
HRD6302	Architecture and organization of computer systems	We study computer architecture with an emphasis on a quantitative approach to the trade-off between cost and performance. Command sets, pipelining, caching, physical memory, virtual memory, superscalar and disordered execution of I / O commands, multithreading, and introduction to multiprocessors with shared memory are considered.	5	BC3	Information and communication technology	Operating Systems
EGR6302	Information theory	Information theory is a branch of applied mathematics and computer science involving the quantification of information. The aim of course is to form a system of knowledge on the basics of information theory and its application to the practice of modern information systems. Objectives of the course: concept and types of information systems, the concept of entropy and ways of its assess, the concept of information, ways of quantify the information, theoretical and practical aspects of efficient coding,	4	BC1	Algebra and geometry	Theory of electrical circuits



		theoretical and practical aspects of noiseless coding, data transfer systems, modulation and demodulation.				
SFT6302	Algorithms and data structures	The principles of algorithm development, analysis of algorithms and fundamental data structures are considered. The emphasis is on choosing appropriate data structures and developing effective and correct algorithms for their implementation. Important elements of the course are measuring the performance and effectiveness of programs when comparing and comparing the results of small programs written in different languages.	3	PC2, PC3	Information and communication technologies	Diploma design
LAN6007K	Business correspondence in the state language	Business language skills are taught. The formation and development of listening, speaking, reading and writing skills on topics related to professional activities, as well as the development of social skills such as presentations.	2	GC2	Kazakh (Russian) language	Graduate design
PP6301	Educational practice	The acquisition of primary professional skills and the consolidation of skills by independently solving the problems of algorithmization, design and practical implementation of programs using modern programming technologies.	2	BC2, PC2, PC3	Algorithmic languages and programming	Industrial practice
RM6301	Research fundamentals	Studying the issues of practical organization of scientific research, analysis and generalization of research results, mastery of the theory of engineering decision making, the basics of project management, requirements analysis, architecture development, detailed design, development of user interfaces and testing methods.	4	BC2	Philosophy	Writing and defending a diploma project
<b>2.2 Elective courses (EC)</b>						
SFT6308	System level programming	This course is based on a class of basic concepts that are necessary for systems based on hardware, firmware, operating systems, applications, platforms and libraries. Key and fundamental aspects of computers are used to develop complex interactions between several independent computing elements that underpin modern machines, with a special emphasis on parallelism.	6	BC3	Operating systems	Microcontroller programming
SFT6305	Database design. Introduction to SQL	During the course, students will learn how to create relational databases, going through all the stages of the database design process (conceptual, logical and physical). In the second part of the course,	4	PC2, PC3, PC6	Information and communication	Diploma design



		students will learn the basics of Structured Query Language (SQL).			technologies	
NET6301	Introduction to computer networks	Acquaintance with the basic network concepts and technologies, as well as developing the skills of planning and implementing small networks. The architecture, structure, functions, components and models of the Internet and other computer networks are considered. The principles and structure of IP addressing, as well as the basics of Ethernet concepts, media and operations, are presented as the basis for the curriculum.	4	PC5	Information and communication technologies	Diploma design
SFT6304	Programming in Python	Familiarity with the Python programming language and its libraries. The emphasis is on procedural programming, non-strict types of variables, designing algorithms, working forms of applications (libraries), object-oriented programming, creating web and database applications, as well as data preprocessing.	4	PC2, PC3	Information and communication technologies	Diploma design
EGR6301	Operating systems	Acquaintance with modern operating systems, their functionality and structure. Methods of process planning, interprocess communication, process synchronization, deadlock processing, main memory management during process execution, classical internal algorithms and storage management structures, and design of an input-output system are considered.	5	BC3, PC5	Algorithms and data structures	Diploma design
SFT6306	Software architecture and design	The study of large systems and how they are decomposed into subsystems and components. Various notations and formalisms, detailed design and architecture are considered. The use of various notation with an emphasis on UML is explored. The role of architecture and detailed project specifications are considered in terms of risk management.	4	PC1	Algorithms and data structures	Diploma design
SEC6301	Fundamentals of information security	It covers basic security concepts, principles and technologies, cryptography, attack methods and security monitoring. Studying basic security methods for searching for threats on the network using various popular security tools in a real network infrastructure.	4	BC2, PC5	Information and communication technologies	Diploma design
<b>3 Professional disciplines (PD)</b>						
<b>3.1 University component (UC)</b>						
PM6301	Project management	Learning the basics of project management and the necessary steps	4	PC1, PC4	Information	Software architecture

		to ensure successful project management. Studying the main characteristics of project management and various roles in the project to ensure success. Application of key skills to the project to evaluate, plan and develop control mechanisms.			Security Basics	re and design Writing and defending a diploma project
LAN6003P A	Professionally-oriented foreign language	Business English skills are taught. The formation and development of listening, speaking, reading and writing skills in English on topics related to professional activities, as well as the development of social skills such as presentations.	3	GC2	Foreign language	Diploma design
PP6302	Industrial practice	The consolidation of theoretical knowledge and the acquisition of practical skills in enterprises.	4	PC2, PC3	Study practice	Pre-diploma practice
PP6303	Industrial practice	Systematization, consolidation and expansion of theoretical knowledge, development of practical skills, mastery of the elements of independent practical and research work in enterprises.	4	PC2, PC3	Study practice	Pre-diploma practice
PP6304	Pre-diploma practice	Search for information for writing the diploma project	5	BC2, PC1, PC2, PC3	Industrial practice	Diploma design
<b>3.2 Elective courses (EC)</b>						
EEC6001	Basic Circuit Theory	The course has been designed to introduce fundamental principles of circuit theory commonly used in engineering research and science applications. Techniques and principles of electrical circuit analysis including basic concepts such as voltage, current, resistance, impedance, Ohm's and Kirchoff's law; basic electric circuit analysis techniques, resistive circuits, 1st order and 2nd order circuits; circuits with DC and AC sources.	4	BC3	Physics	Microcircuitry
SFT6320	Microcontroller programming	The course teaches the skills of designing professionally-oriented information systems by type of software: technical, software, information; methods for the technical design of electronic devices based on microcontrollers; programming skills and microcontroller administration; skills of carrying out integration and modular testing of microcontroller scenarios.	7	BC3	Information and Communication Technology	Circuit Design Language - Verilog
HRD6307	Microprocessor systems and complexes	The objectives of studying the discipline "Microprocessor systems and complexes" are: - studying the general principles of constructing microprocessor systems; - mastering methods for developing and operating microprocessor	5	BC3	Information and Communication	Circuit Design Language - Verilog



		systems from hardware and software points of view.			Technolo gy	
CUM 3255	Digital devices and micro processes	<p>The purpose of this discipline is to form ideas:</p> <ul style="list-style-type: none"> <li>- about the principles of construction, operation and use of digital devices combinational and sequential types, as well as microprocessors in modern radio engineering devices, including computer equipment;</li> <li>- about the operation of digital devices and microprocessors in electronic equipment.</li> </ul> <p>Objectives of the discipline:</p> <ul style="list-style-type: none"> <li>- study of processors flowing in typical units of digital devices;</li> <li>- studying the fundamentals of constructing electronic computing devices (ECD);</li> <li>- study of the arithmetic fundamentals of electronic computers;</li> <li>- study of the architectures of modern ECU microprocessors;</li> <li>- study of specific microprocessor components.</li> </ul>	5	BC3	Electrical Circuit Theory Circuit	<p>Design Language – Verilog</p> <p>Design and modeling of electronic devices</p>
HRD6308	Microcircuitry	The goal of mastering the discipline "Microcircuitry" is the formation of a complex of professional knowledge and skills (possessions) in students and the assimilation of the physical principles of integrated microcircuits, their parameters, characteristics, their theoretical and experimental research and practical application in electronic products.	5	BC3	Electric circuit theory	<p>Circuit design language – Verilog</p> <p>Design and modeling of electronic devices</p>
EEC6002	Design and simulation of electronic devices	The study of semiconductor materials, their characteristics, principles of operation and application. The physics of semiconductors, diodes of p-n junctions, heterojunctions, transistors, metal-semiconductor contacts are considered.	5	BC3	Electric circuit theory	Microproc essor systems and complexes
EEC6004	Fundamentals of logic design	Acquaintance, development and application of digital logic circuits, including combinational and sequential logic circuits.	4	BC3	Electrical Circuit Theory	Circuit Design Language - Verilog
HRD6309	Microelectroni cs	The objective of the course is to study the methods of analysis and calculation of linear and non-linear electric circuits with various input influences; physical principles of action, characteristics, models and features of use in electronic circuits of the main types of active devices; methods for calculating transient processes in electric circuits;	5	BC3	Electric circuit theory	Digital devices and microproce sses



		principles of construction and fundamentals of analysis of analog and digital electronic circuits and functional units of radio electronic equipment, as well as obtaining basic knowledge necessary for further professional activity.				
EEC6006	Digital signal processing	The discipline studies basic methods and algorithms for digital signal processing and their computer modeling using the software package (MATLAB). The specifics of the representation of signals and digital signal processing systems in MATLAB are considered in detail. Linear discrete systems, the synthesis of digital filters and the modeling of these objects and processes using the MATLAB software are described.	4	PC6	Software architecture and design  Microprocessor systems and complexes	Digital signal processing  Circuit design language – Verilog
HRD6304	Sensor technologies	Familiarity with the various types of sensors that are used for industrial automation, environmental assessment, as well as for human-computer interaction.	6	PC7	Logic Design Basics	Circuit design language – Verilog  Design and modeling of electronic devices
NET6304	Cloud Computing and Virtualization	Introductory course from Linux Foundation experts. Learning the basics of cloud computing, terminology, tools and technologies associated with modern cloud platforms. The course displays the entire cloudy landscape and explains how various tools and platforms interact with each other.	5	BC3	Information and communication technologies	Graduation project
MIN601	Minor 1	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies	5	PC7	no	Minor2
MIN602	Minor 2	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies	5	PC8	No	Minor3
SFT6319	Blockchain technology	The Blockchain course is for those who want to learn more about blockchain technology and its applications. The course will look at how blockchain works, what its advantages and disadvantages are, what cryptocurrencies and tokens use blockchain, how to create and	6	PC2, PC3	no	Diploma project

		use smart contracts, and what are the examples of blockchain applications in various fields such as finance, logistics, medicine, etc. others				
MIN603	Minor 3	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies	5	PC6	no	no
SFT6330	Circuit design language - Verilog	Verilog HDL (Hardware Description Language) is a language for text description of hardware. It is used for design, simulation, verification of digital circuits	6	BC3	Microprocessor systems and complex Digital signal processing Circuit design language – Verilog	Graduation project
NET6308	Connecting Networks	This course focuses on the LAN and WAN technologies and network services required in a complex network. Students will be able to integrate several LAN technologies and protocols from previous networking courses, implement WAN interconnection, provide security solutions for IP networks, manage networks in a unified manner.	5	PC7	Network programming	Diploma project
SFT6315	DevOps	The course examines the key concepts and principles of DevOps, organizational factors and automation tools in the development of software products using this method.	5	PC8	Information and communication technologies	Diploma project
<b>5 Final State Attestation:</b>						
NZDP	Writing and defending a thesis, diploma project or preparing and passing a state exam	Writing and defending a thesis, diploma project or preparing and passing a state exam	12			



## 4.4 List of modules and learning outcomes

Module name	Total number of credits	Learning outcomes	Criteria for assessing learning outcomes	Module-forming disciplines
<b>GENERAL EDUCATION MODULES</b>				
<b>General education module</b>	10	The student has an idea of the principles and laws of the historical development of society, the historical periodization of the history of Kazakhstan, the place of the history of Kazakhstan in world history and the history of Eurasia, the place and role of philosophy in the life of society and man; the main stages of development of world and Kazakh philosophical thought.	Testing, interview, term presentation, midterm. oral report, paper,	History of Kazakhstan Philosophy
<b>GENERAL EDUCATION MODULES (ELECTIVES)</b>				
<b>General education module</b>	30	The student understands competencies in the field of rights, the foundations of anti-corruption culture, ecology and life safety. As a result of successful completion of the course, students will have the following competencies: 1. Understand the measures of legal liability for participation in corruption violations. 2. Identify conflicts of interest in the activities of organizations that lead to corruption. 3. Analyze the work of organizations using various research methods.	Testing, interview, term presentation, midterm. oral report, paper,	Research methodology Economic theory Basics of Financial Literacy Fundamentals of law and anti-corruption culture Startups and entrepreneurship Fundamentals safety of life activity and ecology
<b>Social and political knowledge module</b>	16	The student has an idea of socio-ethical values based on public opinion, traditions, customs, social norms and focuses on them in their professional activities; traditions and culture of the peoples of Kazakhstan; the rights and freedoms of man and citizen; the foundations of the legal system and legislation of Kazakhstan; social development trends in society; the basics of physical culture and the principles of a healthy lifestyle.	Testing, interview, term presentation, midterm. oral report, paper,	Political science Sociology Psychology Cultural studies Physical training
<b>Language module</b>	25	The student can freely express himself in writing and verbally, including professionally in the state language, the language of interethnic communication and English; knows how to logically correctly, reasonably and clearly build oral and written speech.	Testing, interview, paper, presentation, midterm. oral term	Foreign language Kazakh (Russian) language Professional Kazakh (Russian) language Professionally-oriented foreign language



BASIC MODULES				
Basic module	9	The student is able to use modern ICT in professional activities, independently versatile and critically analyze modern sources, draw conclusions, argue them and make decisions based on information.	Testing, oral interview, report, term paper, presentation, laboratory work, midterm control.	Information and communication technology
				Research fundamentals
				Algebra and geometry
Math module	22	The student is able to use basic mathematical tools to solve professional problems.	Testing, oral interview, course, laboratory, control work, midterm.	Mathematical analysis
				Theory of probability and mathematical statistics
				Discrete math
Hardware module	48	The student is able to analyze the structure of the main components of the computer, use a wide range of technologies of internal and external memory; write program code for manipulating bits in the processor.	Testing, oral interview, course, laboratory, control work, midterm.	Information theory
				Physics
				Basic circuit theory
				Design and simulation of electronic devices
				Fundamentals of logic design
				Microcontroller programming
				Digital devices and micro processes
				Microcircuitry
				Microprocessor systems and complexes
				Architecture and organization of computer systems
Digital signal processing				
PROFESSIONAL MODULES				
Programming module	18	The student is able to apply suitable data structures and develop appropriate algorithms to solve various computational problems. The student is able to use various tools for software development, user interface, storage and data processing systems.	Testing, oral interview, course, laboratory, control work, midterm.	Algorithmization and programming
				Algorithms and data structures
Advanced programming module	18	The student is able to use various tools for software development, user interface, storage and data processing systems.	Testing, oral interview, course, laboratory, control work, midterm.	Database design. Introduction to SQL
				Programming in Python
Network and system	34	The student is able to administer systems and networks of any configuration, troubleshoot and prevent threats.	Testing, oral interview, course, laboratory, control work, midterm.	Microcontroller programming
				Circuit design language - Verilog
Blockchain technology				
Introduction to computer networks				
Operating systems				
Fundamentals of information security				

administration module				DevOps
				Connecting Networks
				Cloud computing and virtualization
				System level programming
Robotics module	6	The student is able to develop, operate and maintain robotic systems.	Testing, oral interview, course, laboratory, control work, midterm.	Sensor technologies
Project module	14	The student is able to use various software development methodologies, draw up program documentation using the required diagrams, develop models of the logical and physical architecture of the software system, database, and manage the development process.	Testing, oral interview, course, laboratory, control work, midterm.	Economics and organization of production
				Project management
				Software architecture and design



## 5 Curriculum of the educational program

Curriculum of the educational program										Distribution of credits per academic period																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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1	GER	CS	LAN6001A	Foreign language	5	1	1	5/150		45	15	90	5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									</

F-72, Образовательная программа



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34	BS	UC	SFT6319	Fundamentals of Logic Design	4	4	4	4	4/120	15	30.0						15	60							
35	BS	UC	PM6303	Business correspondence in the state language	2	6	6	6	2/60			30					15	15					2		
36	BS	UC	IP6302	Research fundamentals	4	7			4/120	30		15					15	60					4		
37	BS	UC	LAN6003PA	Fundamentals of information security	5	7	7	7	5/150	15	30.0						15	90						5	
38	BS	UC	IP6303	Digital signal processing	5	7	7	7	5/150	30	15.0						15	90						5	
39	BS	UC	SFT6320	Microcontroller programming	6	7	7	7	6/180	15	30	15					15	105						6	
40	BS	UC	SFT6308	System Level Programming	6	7	7	7	6/180	30		30					15	105						6	
41	BS	UC	SFT6319	Blockchain technology	6	8	8	8	6/180	15	30	15					15	105						6	
42	BS	UC	PM6303	IT project management	5	8	8	8	5/150	15	30						15	90						5	
43	AS	UC	IP6302	Industrial practice	4	4			4/120								0	0				4			
44	AS	UC	LAN6003PA	Professionally oriented foreign language	4	5	5	5	4/120			45					15	60					4		
45	AS	UC	IP6303	Industrial practice	4	6			4/120								0	0							
46	AS	UC	PP6304	Pre-diploma practice	5	8			5/150								0	0							5
47	AS	ES	MIN601	Minor 1	5	5	5	5	5/150	15	30						15	90					5		



48	AS	ES	HRD6304	Sensor Technologies	6	5	5	5	6/180	30	30	30	15	105					6			
49	AS	ES	HRD6307	Microprocessor systems and complexes	5	5	5	5	5/150	15	30		15	90				5				
50	AS	ES	CUM 3255	Digital devices and micro processes					5/150	15	30		15	90								
51	AS	ES	HRD6308	Microcircuitry	5	5			5/150	15	30		15	90				5				
52	AS	ES	HRD6309	Microelectronics					5/150	15	30		15	90								
53	AS	ES	MIN602	Minor 2	5	6			5/150	15	30		15	90					5			
54	AS	ES	EEC6002	Design and simulation of electronic devices	5	6			5/120	15	30		15	60				5				
55	AS	ES	NET6304	Cloud Computing and Virtualization					5/150	15	30		15	90								
56	AS	ES	SFT6330	Circuit design language - Verilog	6	6			6/180	30	30		15	105					6			
57	AS	ES	NET6308	Connecting Networks	5				5/150	15	30		15	90				5				
58	AS	ES	SFT6315	DevOps					5/150	15		30	15	90								
59	AS	ES	MIN603	Minor 3	5				5/150	15	30		15	90							5	
				Weekly average workload at hours												0	0	0	0	0	0	
1	General education subjects(GER)				56			12	1680	120	30	390	0	180	960	10	9	15	4	9	0	0
	Core subjects(GER/CS)				51			11	1530	105	30	360	0	165	870	10	9	15	4	4	0	0
	University component(GER/UC)				0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	


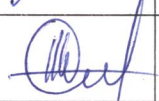
	Electives(GER/ES)	5			1	150	15	0	30	0	15	90	0	0	0	0	0	0	5	0	0
2	Base requirements(BS)	112			23	3300	435	495	210	60	360	1800	18	23	20	12	0	2	26	11	
	Core subjects(BS/CS)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	University component(BS/UC)	112			23	3300	435	495	210	60	360	1800	18	23	20	12	0	2	26	11	
	Electives(BS/ES)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	
3	Profession requirements(VRS)	64			10	1500	165	180	135	390	150	870	0	0	0	4	25	20	5	10	
	Core subjects(VRS/CS)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	University component(VRS/UC)	17			9	120	0	0	45	390	15	60	0	0	0	4	4	4	0	5	
	Electives(VRS/ES)	47			1	1380	165	180	90	0	135	810	0	0	0	0	21	16	5	5	
4	Disciplines for the formation of professional competencies(BDFPC)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Core subjects(BDFPC/CS)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	University component(BDFPC/UC)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Electives(BDFPC/ES)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	Disciplines of personal development and the formation of leadership qualities(BDPD)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Core subjects(BDPD/CS)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	University component(BDPD/UC)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Electives(BDPD/ES)	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total on curriculum	232				6480	720	705	735	450	690	3630	28	32	29	31	29	31	31	21	
6	Additional courses																				



7	Module of final certification (MoFC)	8	240	
	Total including FCS	240	7200	

**6 Developer approval sheet**

The title of the educational program: 6B06106 «Computer Systems and Software Engineering»

№ п/п	Position, degree, last name and initials of a developer of the educational program	Date	Signature	Note
1	PhD, head of the «CE» Department, assistant professor T.T. Chinibaeva			
2	Ph.D., assoc. Professor of the «CE» Department Seilova N.A.			
3	MSc, senior-lector of the «CE» department Bekaulova Zh.M.		